GT Systems™ DISCUSSION PAPER

How to implement open caching, globally, today

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TCP/IP is as dumb as a rock. To support video content at scale and acceptable QoS, along with next gen apps such as XR, IoT and AI, the Internet must understand what it is carrying, who for, and why. Initiatives such as Content Centric Networking (CCN), Information Centric Networking (ICN), and Name Domain Networking (NDN) have pioneered this concept. SPAN takes it to a whole new level.

Quotes from the Streaming Video Technology Alliance (SVTA)

https://www.svta.org/svta-members/

"What if the ISPs could pull video content from local cache? an in-network, open caching system."

*"Content providers are feverishly trying to provide a solution for their viewers that either closely mimics traditional broadcast or, **in some ways, even exceeds it**."*

*"As online streaming video grows in popularity, increasing audience sizes will put more demands on network operators and content distributors. Massive live events and popular VOD content will require more capacity, better resiliency, and heightened operations [elasticity]. This content **may also require potentially different delivery approaches**"*

SPAN-AI is the "potentially different delivery approach" that delivers all the objectives of the SVTA. Today. And in many ways, exceeds traditional broadcast.

GT Systems has spent 10 years of privately funded research devoted to solving these problems. We have collaborated with leaders in the field: CSIRO, Bell Labs, Protocol Labs, the IETF and IRTF; and stood on the shoulders of giants: Bram Cohen[1], Van Jacobson, Juan Benet, Lixia Zhang, Jaime Llorca. The result is a protocol (SPAN-AI) and network operating system (SPANOS) that can be used to build a Universal Content Distribution Network (UCDN) that solves ***every*** objective of the SVTA and more. It may be the foundation of the next generation of the Internet.

[1] BitTorrent is a genius protocol and the first to apply content centric networking. Unfortunately, it has been used for "evil" (illegal file sharing) and works a little too well at that! Bram's ideas have, however, sowed the seeds for the next generation of the Internet. Credit where it's due.

"Rhett, it is my duty to help you"

Lixia Zhang, Internet Hall of Fame, founding member, IETF

"You're living the dream dude!"

Terry Percival, AO, Research Director CSIRO (retired) and the father of WiFi

What is SPAN-AI?

GT Systems is pioneering the use of AI/ML in the operation of the Internet. We're doing that by leading the transition to Information Centric Networking and intelligent routing. We use intelligent SPAN agents to optimise local routing and operations and a global optimising AI that also trains agents. Simply put, SPAN-AI enables ISPs, telcos and CDNs to distribute studio quality, on-demand, and live video in the way the SVTA envisages: with minimal latency, no buffering, fuzziness or dropped frames; with no encode ladders; cached at the optimum place in the network; AND TO GET PAID FOR DOING THAT.

How do we do that?

By installing a SPAN intelligent agent, protocol stack and caching storage on your routers, switches, servers, home gateways, etc. We provide content owners with a SPAN SDK to implement SPAN in their apps. Job done. We take care of the rest. Including rating and billing and making sure you get paid.

WTF?

"Woah hold on that's not so easy! And who's we?" I hear you say.

Well, actually, yes, it is that easy. And "we" is us and you. Every ISP, telco, CDN and content owner on the planet. Because, unless we all co-operate, no-one on their own is getting this done.

"But that's re-engineering the Internet!!!???"

Yes, it is. Trying to do this with TCP/IP and the www isn't going to work because it's as dumb as a rock. We know. We've modelled it with the most sophisticated network models in the world. And **you** know that, in your heart of hearts. But the alternative scares the @#$%& out of you. It would have scared us too, 10 years ago, if we thought in those terms. But we were "only" trying to solve the "spinning wheel of death" in video distribution. The rest happened almost by osmosis, over time. One foot in front of the other. One bite at a time. Etc. And now, we find ourselves here, talking about potentially solving some of the biggest problems in the video business. No-one is more surprised about this than us. But some of the smartest people in the world, and in the Internet, think this has potential. That's why we've kept going, and why we are writing this.

So, assuming this works, who's going to pay us?

The content owners. Sorry guys, but bear with us, you get a better result for the same or less money than you're currently paying. Honest. And you get to remove the OTT platform line from your operational and capex budgets. All of it. We've been working with ***all*** the Hollywood studios for 10 years. We know what you want. Studio quality 4K/8K HDR WCG and above, delivered securely, anywhere in the world, with a definable QoS and zero buffering, frame drop or "fuzziness". With full audience stats. At a reasonable cost.

The best comment on that 10 year journey was Aleisha MacAulay, head of digital for Fox in Aus, back when we were just p2p, who said "*Rhett, the peer word makes us nervous, but we're coming with you!*". The next best was Tim Wright, head of Security for Sony at the time (now at Amazon) "*Thanks Rhett and Andrej. This [Blust] has technical approval (subject to contractual agreement). Thanks very much for your comprehensive response. If only all licensees were like this!*" He was referring to our Blust appliance with Secure Peer Assist (SPA, the predecessor to SPAN-AI). The world's first (and still only?) legal, open, Windows/Intel based, p2p movie distribution platform in the world. Oh yeah, and the next best was Bill Lewis, principal engineer at Intel, when we pointed out a security hole on the Intel processor in the NUC that Blust was built on. He said "I wish we spoke to you guys 2 years ago!".

How will they pay us?

Good question. SPAN-AI includes light-weight, zero-knowledge, proofs of routing and storage. It is intelligent, self-optimising, and content based. That means it knows the name of every bit of content, where it is sent, by whom, from whom and to whom, and via what nodes and edges (links), real and virtual. That means we can do rating and billing, on everything, today. Content owners publish ("ingest") ***once***, to the network, with an associated QoS spec and cost. The network takes care of distributed storage and retrieval (distribution). Publish and subscribe. And billing. You get paid for the resources you contribute and, if they aren't chosen, you get told why so you can improve. This is Open Caching on steroids.

Is it secure?

High value content, e.g. studio masters, are encrypted at ingest (publish) with MovieLabs acceptable encryption in MPAA approved facilities. All content packets are signed by the publisher, thus verifying source. Storage is fully distributed, making DOS attacks difficult. Identity is sovereign, at the edge of the network, forming the basis of sovereign data, something everyone in the world wants today.

Does it scale?

We have modelled this using the most sophisticated graph edge-based models in the world, developed over 10 years at Bell Labs, and yes, it scales. We have working PoC ICN router code that is proven up to Tbps and beyond on COTS general purpose hardware. And here's an added bonus: SPAN-AI is 10X faster (less lag) and 10X cheaper (when supplied on hardware) than centralised, hierarchical, architectures. It's even cheaper if you just need SPAN software agents on your own, open switches. Turns out (counter-intuitively) that fully distributed is cheaper than centralised after all. Much cheaper. Who knew?

(Well, we did)

It does live streaming???

Yep. With bells on. Multicast is inherent in Information Centric Networking. SPAN is effectively a layer 2 protocol with ***inbuilt*** mechanisms to prevent loopback and enable multicast. It can also work at layer 3. SPAN-AI waterfall cascades live streams to optimum nodes for ongoing multicast. This enables live streams in premium quality with minimal latency that actually ***improve*** with more nodes/viewers.

What APIs do you need?

We need three. Count 'em. 3. (This is because we AREN'T using TCP/IP and the www)

1. Intelligent routing API
2. Intelligent local optimisation API
3. Global optimisation API

These are AI APIs. We're inventing those too.

What is SPAN HARD?

SPAN-AI-HARD is our intelligent, hybrid, adaptive, routing design that combines the benefits of name-resolution-based routing and storage (i.e. routing by resolving names and addresses by lookup e.g. IP and DNS or CID (hashes) and IPFS); with name based routing and distribution i.e. intelligent local and global routing by content names and interest without costly lookups. Our unified naming and addressing system is what glues this all together.

Does this have legs?

Van Jacobson[2] (the guy who fixed the Internet when Tim Berners-Lee broke it) invented Content Centric Networking to address the limits of TCP/IP and the www. CCN/NDN/ICN are all based on the original ideas of Bram Cohen and BitTorrent which, as we know, works a little ***too*** well. Lixia Zhang, who invented RSVP and co-invented SCTP, thinks we have what is needed to make ICN real and scalable. So do most of the members of the ACM Information Centric Networking community and the IRTF Information Centric Networking Research Group https://irtf.org/icnrg Also Terry Percival, the father of WiFi, and Professor Hugh Durrant-Whyte, NSW chief scientist and ex-chief scientist of the UK DoD.

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FOUNDATION RESEARCH BODY OF WORK

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David B Jackson, AI development
https://patents.google.com/?q=lll+Holdings&inventor=david+b+jackson&oq=lll+Holdings+david+b+jackson

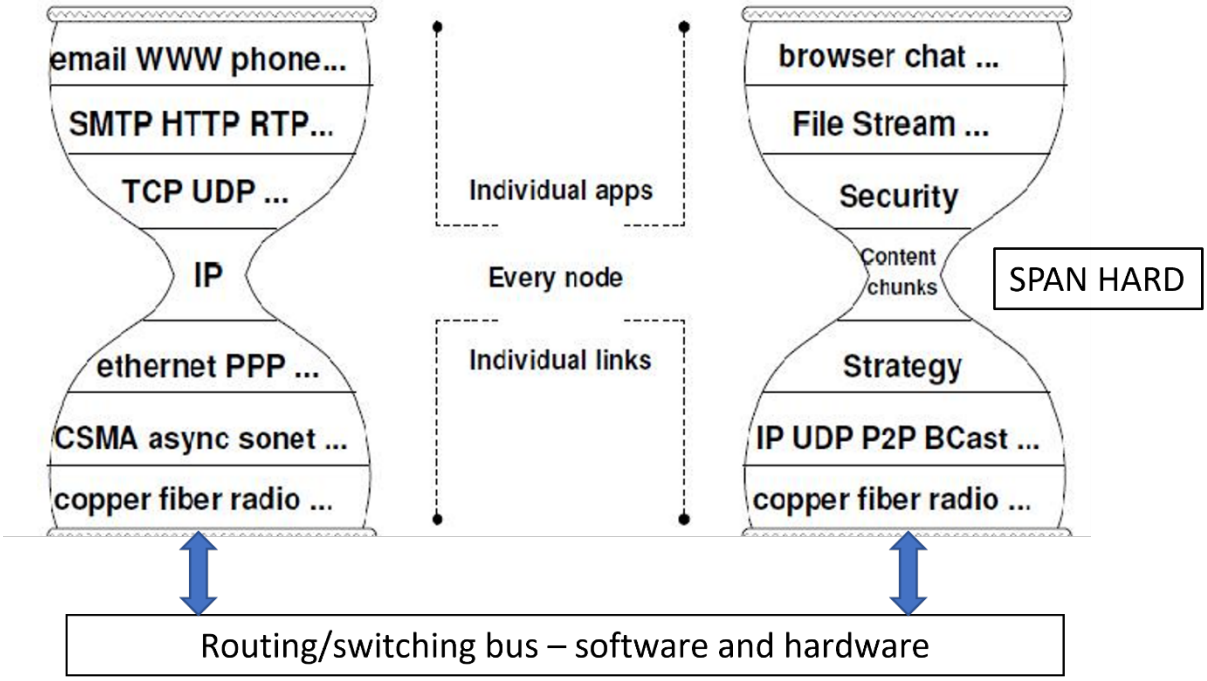
DIAGRAMS

SOME OF THE STUDIOS AND STREAMING SERVICES IN THE STREAMING VIDEO TECHNOLOGY ALLIANCE

[2] https://en.wikipedia.org/wiki/Van_Jacobson

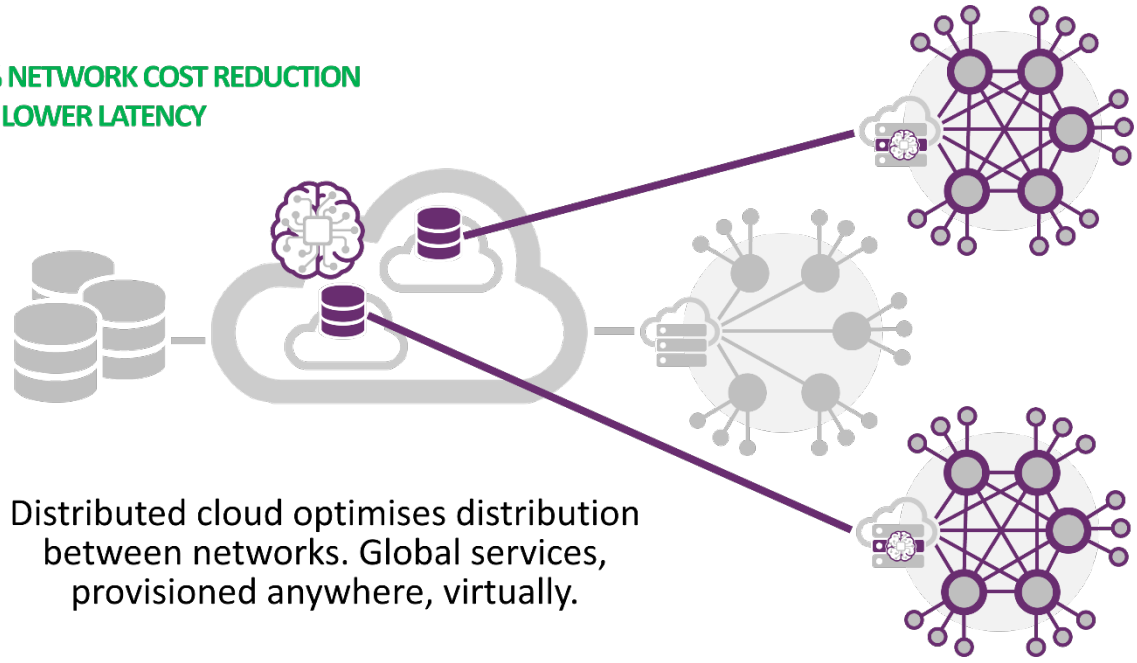
NETFLIX

"A COOPERATIVE [OPEN CACHING] MODEL IS WIN-WIN FOR CONSUMERS"



DUAL STACKS, IP AND SPAN, ON EVERY DEVICE. CACHING STORAGE ON EVERY DEVICE.

90% NETWORK COST REDUCTION
10X LOWER LATENCY



Distributed cloud optimises distribution between networks. Global services, provisioned anywhere, virtually.

A GLOBAL, FEDERATED, UNIVERSAL CONTENT DISTRIBUTION NETWORK OF INTELLIGENT NETWORKS